

REMARKS

Claims 1-28 were presented for examination and were pending in this application. In the latest Office Action, claims 1-9, 12-17, and 28 were rejected, and claims 10, 11, and 18-27 were objected to as dependent on a rejected base claim but otherwise allowable. With this amendment, claim 5 is amended.

Claim 5 was objected to as not having proper punctuation. With this amendment, claim 5 is amended to correct this error.

Claims 1-3, 7, 8, 12-14, 16, and 28 were rejected as anticipated by U.S. Patent No. 6,011,639 to LaFiandra. Applicants respectfully traverse this rejection because LaFiandra does not disclose each of the claimed limitations.

The claimed invention enables a deformable mirror that uses an electro-resistive material (such as a piezoelectric material) to deform the mirror. The electro-resistive material deforms when electrical energy is applied to it via an electrode. Previous deformable mirror solutions couple the electrodes to a power supply using a plurality of wires. Disadvantageously, the use of wires is difficult and time consuming, and it can take hours to assemble the connections for a single mirror. Further, the connections can distort the mirror, and the connected wires add mass to the mirror and thus affect the resonant frequency of the mirror.

To avoid the problems of previous solutions, the claimed invention couples the electrodes using conductive traces rather than wires. For example, independent claim 1 recites an adaptive optics system that includes “a plurality of conductive traces formed on the insulating layer, each conductive trace coupling an electrode to a perimeter region of the deformable mirror,” and independent claim 12 recites a deformable mirror that includes “a plurality of conductive traces,

each conductive trace electrically coupling an electrode to a perimeter region of the deformable mirror.” In each of these claims, the recited “plurality of conductive traces” avoids the use of wires to couple the electrodes to a power source and thereby avoids the problems associated therewith.

LaFiandra does not disclose a device having a plurality of conductive traces that couple the electrodes to a perimeter region or otherwise for coupling to a power source. As shown in FIG. 3, LaFiandra’s device incorporates an array of stacked piezoelectric actuators, and between the actuators are electrodes of alternating polarity. This allows the piezoelectric actuators to operate in parallel electrically and in series mechanically. This structure, however, does not lend itself to the use of conductive traces to couple the electrodes to a power source. Instead, as LaFiandra explains, conductor wires must be attached to each stack of piezoelectric actuators to connect to the electrodes of each polarity (i.e., two wires per stack):

As best seen in FIG. 3, the silk screened electrode pattern on alternate layers is exposed to one side of each actuator and a conductor wire 32 is run the full length thereof making electrical contact with each associated alternate layer. Each wire conductor 32 is subsequently connected to the actuator drive electronics for electrical actuation purposes.

(LaFiandra, col. 3, lines 47-52.) Given the vertical stacking of the electrodes in LaFiandra’s device, it is neither disclosed nor apparently feasible to use conductive traces to perform the coupling done by LaFiandra’s wire conductors. The conductor wires are then lead out to an outside of the structure by a series of thin flexible conductors, as described:

Each row of actuators 10,10 has a thin flexible conductor with a lead 49,49 tracing from each actuator row and terminating on either end of the row with connectors 51,51.

(LaFiandra, col. 4, lines 14-16.) For each stack of actuators, therefore, LaFiandra uses a pair of wires attached along the height of the stack to couple the electrodes, and then another pair of flexible conductors to allow coupling the electrodes to an energy source.

In the Office Action, it was asserted that LaFiandra teaches the use of conductive traces to couple the electrodes to a perimeter region of the mirror. Applicants respectfully disagree. LaFiandra explains that the flexible conductors “trace” from each stack of actuators to the end of the row of actuators in the array. However, LaFiandra uses the word “trace” not to describe the structure of the flexible conductors, but rather their orientation. The flexible conductors may *trace* from the actuators to the leads, but the flexible conductors of LaFiandra are not conductive traces as claimed. Accordingly, LaFiandra does not anticipate the rejected claims.

Dependent claims 4, 9, and 17 were rejected as made obvious by LaFiandra. In this rejection, LaFiandra was applied to the claims in the same way as it was applied to the claims discussed above, and it was further asserted in the Office Action that the additional claim limitations of bonding pads and a zebra strip connector would be obvious to one of skill in the art. Although Applicants respectfully disagree with these conclusions, claims 4, 9, and 7 are patentable over LaFiandra at least for the reasons provided above. In particular, LaFiandra does not suggest the use of conductive traces to couple the electrodes to a perimeter area of the mirror or otherwise for coupling to a power source. With respect to the additional claimed limitations of bonding pads and strip connectors, Applicants further assert that it would not have been obvious to modify LaFiandra’s device to include these features. In particular, given the structure of LaFiandra’s device, it is not clear how a bonding pad and strip connectors would be beneficial for making the claimed electrical connections.

Claims 5 and 6 were rejected as made obvious by LaFiandra in view of U.S. Patent Pub. No. 2002/0131146 to Gee et al. The examiner cited Gee only for its additional disclosure of a protective coating, such as a dielectric material, covering a portion of the conductive traces.

Accordingly, the combination of Gee's protective coating onto LaFiandra's device does not render claims 5 and 6 obvious because of the deficiencies in LaFiandra mentioned above.

If the examiner believes for any reason direct contact would help advance the prosecution of this case to allowance, the examiner is encouraged to telephone the undersigned at the number given below.

Respectfully submitted,

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